

## CLAIMS

What is claimed is:

1. An apparatus for focusing, deflection and aberration-correction of ion optical components used for implanting a plurality of charged particles into semiconductor materials thereby modifying properties of said semiconductor materials said apparatus comprising:

a structure manufactured from a magnetic material said structure having a long dimension and a short dimension;

an upper magnetic core member having said long dimension between its ends;

a lower magnetic core member having said long dimension between its ends said lower core member being oriented with its axis substantially parallel to the axis of said upper core and its ends substantially aligned with the ends of said upper core member;

a plurality of independent current excited coil units distributed along both said core members each said coil unit comprising a single continuous electrical circuit that surrounds an individual core member; and

additional magnetic members connected between ends of said upper and lower magnetic core members to form the short dimension of a rectangular frame.

2. The apparatus of claim 1 wherein said members of the plurality of independently current excited coil units are equally spaced.

3. The apparatus is claim 1 wherein the said independently excited plurality of coil members have an identical number of coils.

4. The apparatus of claims 1 wherein said short dimension members of said structure comprise a non-magnetic material.
5. The apparatus of claim 1 wherein a plurality of independently current excited electrical windings encircle one or both of said short dimension members.
6. The apparatus of claim 1 wherein a single current excited winding encircles one or both of said short dimension core members.
7. The apparatus of claim 1 wherein individual ones of said current excited coil units are super conducting.
8. The apparatus of claim 1 further comprising a current controller for independently changing the current passing through said individual coil units and producing a controllable magnetic field configuration between said upper and lower magnetic core members.
9. An apparatus for focusing, deflection and aberration-correction of ion optical components used for implanting a plurality of charged particles into semiconductor materials thereby modifying properties of said semiconductor materials said apparatus comprising:
  - an upper basic magnetic core member having a long dimension between its ends;
  - a lower basic magnetic core member having said long dimension between its ends said lower core member being oriented with its axis substantially parallel to the axis of said upper basic core member and with its ends substantially aligned with the ends of said upper core member;
  - a plurality of independent current excited coil units distributed along both said upper and lower basic magnetic core members, each said coil unit comprising

a single continuous electrical circuit that surrounds an individual basic magnetic core member;

magnetic core extension units that are attached in a linear array to each end of both upper and lower basic core members; and

a plurality of independent current excited coil units distributed along said magnetic core extension units, each said extension coil unit comprising a single continuous electrical circuit that surrounds an individual core extension unit.

10. The apparatus of claim 9 wherein each of said magnetic core extension unit has a length equal to one half that of said long dimension.

11. The apparatus of claim 9 wherein the plurality of independent current excited coil units distributed along individual core extension units are equally spaced.

12. The apparatus of claim 9 wherein said coil units distributed along each said basic core extension units are connected in series.

13. The apparatus of claim 9 wherein said coil units distributed along a core extension unit are wound serially in the form of a single winding.

14. The apparatus of claim 9 wherein for each of said upper and lower basic core units the sum of the ampere-turns generated by the coils surrounding said basic magnetic core member is equal and opposite to the sum of the ampere turns generated by the coil units distributed along said basic magnetic core members.